

An Assessment of Causes of Building Collapse in Nigeria

(Case Study of Birnin Kebbi, Kebbi State)

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ABSTRACT

In human life, shelter forms a second primary needs of human apart from food and because of this, many people act desperately in order to have their own properties. As a result, the need to erect strong and functional structures to do away or minimize building collapse is very important. The aim of this paper is to assess the causes of building collapse in Nigeria to ensure standardization in building fabrication, through identification of the causes of building failure that leads to collapse, also to examine the effects or problems associated with building failure that leads to collapse and to proffer solutions to the problem. The field survey method was employed for this research, a total of one hundred (100) questionnaires were distributed. Not every questionnaire that was distributed was fully completed and returned. Ninety-one (91) questionnaires were filed and returned. The collected data were analyzed and presented using a straightforward statistical method that included tabulating the data and converting the numerical values into a simple percentage. the findings of this paper revealed that, Collapse of Buildings may happen due to the following; Poor workmanship, use of poor or substandard building materials, bad design, foundation failure, faulty construction, un-designed loads and design fault, etc. As such, the need to stop/minimize building collapse in this country is necessitated, with more emphasis to, Birnin kebbi, Nigeria because it numerous cases of building collapse and needs immediate solution. However, appropriate recommendations were made at the end of the research.

Keywords: Building collapse; Building failure, Building Materials; Building professional;

GENERAL INTRODUCTION

The safety of people and property is seriously threatened as various states in Nigeria record varying incidences of building collapse nationwide (Dimuna, 2012; Dimuna, 2010). Given these issues, it is imperative that research be done to determine the causes of structural failure that result in building collapse in this nation (Dimuna, 2012). This research will examine the numerous reasons why buildings in Nigeria collapse and potential solutions to this problem. Failure is the opposite of success and happens when the intended results are not realized (Merriam-Webster, 2021). Stated differently, it can be understood as a structure's incapacity to preserve its structural integrity (Ellingwood & Dusenberry, 2005). A building collapse, according to Ayodeji (2011), is characterized as a condition of complete building failure in which the majority of the building's components have collapsed or buckled. Additionally, according to (Ayodeji, 2011), a building collapse occurs when one or more of its components completely or partially fail, making it impossible for the structure to fulfill its primary purpose of providing stability, comfort, and safety. In

relation to these, stability and safety are lost, and building collapse may impact an entire building or just a portion of it (Oloke et al., 2017). These indicate that a building's partial collapse suggests that some of its main structural elements have failed, while a building's total collapse indicates that many of its primary members have completely failed.

Nigeria has recorded a number of building collapse cases, including those in Port Harcourt, Abuja, Ibadan, Lagos, and Kano. Lagos has the highest number of building collapse cases, according to Oloke et al. (2017). There have also been instances of building collapse in Kebbi, the majority of which go unreported. In the Kebbi state area of Arewa Local Government, a building collapsed in Yeldu town. As a result, the entire six-person family perishes, and all of their possessions and building materials are also lost (Mansur Hamma-adama, 2017). Also, the report states that three under-construction buildings were discovered to have collapsed during a personal survey of the study area. A minimum of fifty (50) buildings in Birnin Kebbi have collapsed, with 70% of the 50 houses being from Birnin Kebbi. In addition, building materials and components are sold in markets without a legal authority's permission, and there are no limitations on the kinds, standards, or even dimensions of these materials. It is also mentioned that deteriorating quality is a factor in this building materials issue (Okeke et al., 2020; Ayodeji, 2011). Furthermore, testing facilities are lacking, making it impossible to test these building materials and components before standards for high-quality projects are set (Ayodeji, 2011).

However, subpar workmanship and design make it extremely difficult for employees to enforce quality control during building production, which can ultimately result in subpar construction and the collapse of a building (Okeke et al., 2020). In keeping with these issues facing the building and construction sectors, this paper aims to offer a potential solution to these issues by posing the question of what might be the root causes of building failures that result in building collapse.

This paper aims to evaluate the reasons behind building collapses in Nigeria in order to guarantee building fabrication standards.

The goals are to determine what causes a building to fail and collapse, to investigate the consequences or issues that arise from this failure, and offer solutions to the issues.

LITERATURE REVIEW

Causes of Building Failure that leads to collapse

Failure is the result of defect; according to Okagbue et al. (2018), a "defect" is defined as an early failure of a building's structural members as well as a failure brought on by subpar engineering, manufacturers, application, design, and installation. According to Ellingwood and Dusenberry (2005), a "failure" is defined as a structural deformation or an inability to perform well, a deformation on the aspect of appearance, operation, workability, or qualities of structural members. When a building's component is unable to carry out its main duties, a failure has occurred (Dorcas, 2017).

According to Ellingwood and Dusenberry (2005), deflection on a structure that results in some displacement is regarded as a defect but not a failure, whereas excessive displacement that seriously damages any of the main structural members is classified as a failure. Nice-looking homes with construction flaws would require a lot of maintenance, which would be indicative of a lack of expertise on the part of those producing the buildings (Dorcas, 2017).

According to research by Okagbue (2018), the use of inferior materials ranks first among all other causes of building defects; this could lead to price reductions in order to increase profit. This type of error can result in a "Design Error." He continued by identifying the following elements as the primary or significant reason

why buildings in this nation fail: Environmental factors; mistakes in design; use of inferior building materials; poor craftsmanship; inadequate construction methods; absence of a maintenance culture; incompetent subcontractors.

Regarding the cure or solution for building collapse, numerous studies show that building failure resulted in numerous issues and had a significant negative impact on this nation’s economic development (Anosike, 2021). Building collapse therefore requires careful consideration in order to mitigate its effects. (Akinlolu-raphael & Babatunde, 2019).

RESEARCH METHODOLOGY

The study concentrated on building collapse in Nigeria that results from issues related to design, craftsmanship, or usage, with a particular emphasis on Birnin-Kebbi as the case study area (residential and/or commercial buildings). The number chosen at random from the sample’s list unit is the sample size. The Yaro Yamane formula was used to determine the research’s sample size. The following is the presentation of Yaro Yamane’s calculation formula:

Where n = sample size required, N = number of people in the population, e = allowable error (10%) (Onyeze, 2015). Therefore,

$$n = \frac{33,078}{1 + 33,078(0.1)^2} = 99.7$$

Since $n = 100$ approximately, 100 will be the sample size for this study. The research objectives guided the design of one hundred (100) questionnaires.

Both primary and secondary sources of data were used in this research. While the data gathered through a field survey were analyzed and presented, all data obtained through secondary sources were included in the literature review of this study. The formal survey were employed. For this research, a total of one hundred (100) questionnaires were distributed.

Not every questionnaire that was distributed was fully completed and returned. Ninety-one (91) questionnaires were filled and returned.

DATA PRESENTATION AND ANALYSIS

The collected data were analyzed and presented using a straightforward statistical method that included tabulating the data and converting the numerical values into a simple percentage in order to present the main question in more detail.

Information of Respondent.

Table 4.1: Demographic Profile of Respondent

S/no	Variables	Category	Frequency	Percentage (%)
1	Gender	Male	77	84.6
		Female	14	15.4
Total			91	100

2	Specialization of Respondent	Architects	9	9.9
		Project Managers	32	35.2
		Structural engineers	19	20.9
		Building owners/ occupants	16	17.6
		others	15	15.5
Total			91	100
3	Education Level	Primary/Secondary level	14	15.4
		Tertiary level	69	75.8
		No basic education	8	8.8
Total			91	100
4	Duration of Experience	1-5 years	40	44
		6-10 years	28	30.8
		11- 15 years	17	18.7
		16 and Above	6	6.6
Total			91	100

Table 4, 1 above shows that there are 14 respondents (15.4%) and 77 respondents (84.6%) who are female and male respectively, making up the sample population. This suggests that there are more men than women among professionals and other groups in Birnin Kebbi. Additionally, 69 respondents, or 75.8% of the sample population, have completed postsecondary education, 14 respondents, or 15.4%, have completed primary or secondary education, and 8 respondents, or 8.8%, have not completed any form of basic education. This suggests that nearly every respondent in the study area is sufficiently educated and knowledgeable to provide accurate information. The study also shows that experts in architecture make up 9 respondents (9.9%) of the sample population as a whole; building owners/occupiers make up 32 respondents (35.2%); project managers make up 19 respondents (20.9%); structural engineers make up 16 respondents (17.6%); and quantity surveyors make up 15 respondents (16.5%). This suggests that the majority of respondents were building owners or occupants, which increases the credibility of the information provided. □According to the study, 40 respondents (44%) have worked in the field for one to five years, 28 respondents (30.8%) have worked in the field for six to ten years, 17 respondents (18.7%) have worked in the field for eleven to fifteen years, and 6 respondents (6.6%) have worked in the field for more than sixteen years. This suggests that each respondent has experience in their respective field of expertise.

Causes of Building Failure That Leads to Collapse

Table 2: Frequency of Building Collapse at Birnin Kebbi

Option	Frequency	Percentage (%)
Very common	22	24.2
Common	40	44
Not common	21	23.1
Undecided	8	8.8
Total	91	100

According to the study, 22 respondents (24.2%) of the sample said that building collapses occur frequently in the Badariya area, 40 respondents (44%) said that they occur frequently, 21 respondents (23.1%) said that

building collapses do not occur frequently in the Badariya area, and 8 respondents (8.8%) are unsure. This suggests that building collapse in Birnin Kebbi is frequent.

The Major Causes of Building Collapse

Table 3: The Major Causes of Building Collapse

Causes	Frequency	Percentage (%)
Poor Workmanship	18	19.8
Lack of Maintenance	8	8.8
Faulty Foundation	18	19.8
Bad design	10	11
Sub-Standard Materials	37	40.7
Total	91	100

According to the study, 37 respondents (40.7%) believe that it is due to the use of inferior materials, 18 respondents (19.8%) believe it is due to poor workmanship, 18 respondents (19.8%) believe it is as a result of faulty foundation, 10 respondents (11%) believe it is due to poor design, and 8 respondents (8.8%) believe it is due to lack of maintenance. This suggests that, as the above table illustrates, the primary factor contributing to building collapse is the use of inferior materials.

Type of Property That Collapse Mostly

Table 4: Type of Property That Collapse Mostly

Properties	Frequency	Percentage (%)
Residential	54	59.3
Commercial/ Educational	26	28.6
Industrial buildings	11	12.1
Total	91	100

According to the study, out of the total sample population, 54 respondents (59.3%) choose residential property as the type that collapses most frequently, followed by 26 respondents (28.6%) who choose commercial property, and 11 respondents (12.1%) who choose industrial buildings. This suggests that, as the table above illustrates, residential properties are more likely to collapse.

Table 6: The Effects of Building Collapse on Human Lives

Rate	Frequency	Percentage (%)
Very high	28	30.8
High	37	40.7
Fair	22	24.2
Undecided	4	4.4
Total	91	100

According to the study, 28 respondents (30.8%) of the sample as a whole rate the effect of building collapse on human lives as Very High, 37 respondents (40.7%) of the sample as High, 22 respondents (24.2%) of the sample as Fair, and 4 respondents (4.4%) of the sample as undecided. Based on the table above, it can be

concluded that there is a high risk of building collapse resulting in human casualties

Table 8: The Rate of Effects of Building Collapse on Properties

Rate	Frequency	Percentage (%)
Very high	28	30.8
High	35	38.5
Fair	26	28.6
Undecided	2	2.2
Total	91	100

According to the study, the impact of building collapse on properties is rated as Very High by 28 respondents (30.8%) of the total sample population, High by 35 respondents (38.5%), Fair by 26 respondents (28.6%) of the total sample population, and Undecided by 2 respondents (2.2%) of the total sample population. As the above table illustrates, this suggests that there is a high risk of property damage from building collapse.

Table 9: The Effect of Building Collapse on Housing Development

Rate	Frequency	Percentage (%)
Very High	22	24.2
High	42	46.2
Fair	23	25.3
Undecided	4	4.4
Total	91	100

According to the study, 22 respondents (24.2%) rate the effects of building collapse on housing development as Very High, 42 respondents (46.2%) rate it as High, 23 respondents (25.3%) rate it as Fair, and 4 respondents (4.4%) are unsure. This suggests that, as the table above illustrates, there is a connection between the development of housing and the collapse of buildings.

Suitable Solution to the Problems Associated with Building Collapse

Table 10: have Efforts Been Made to Eradicate Building Collapse?

Option	Frequency	Percentage (%)
Yes	71	78
No	20	22
Total	91	100

Source: Field Survey, March, 2022

According to the study, 71 respondents, or 78% of the sample as a whole, said efforts have been made to eradicate building collapse, while 20 respondents, or 22% of the sample, said no such efforts have been made. This suggests that, as the above table illustrates, efforts have been made to end building collapse throughout Nigeria, and specifically in the Birnin Kebbi area.

Table 11: Ways Developers Can Minimize Building Collapse

Ways	Frequency	Percentage (%)
Complying with statutory building regulations	42	46.2
Proper maintenance culture	17	18.7
Stopping Dealing with Quacks	32	35.2
Total	91	100

Source: Field Survey, March, 2022

According to the study, 32 respondents (35.2%) of the total sample population believe that stopping dealing with quacks can minimize building collapse, while 17 respondents (18.7%) of the total sample population believe that proper maintenance culture can minimize building collapse. 42 respondents (46.2%) of the total sample population agree. This suggests that, as indicated by the respondents, following statutory building regulations has the potential to reduce the likelihood of a building collapsing, but there is also potential for other approaches, as indicated by the above table.

Table 12: Solution to the Problems Associated with Building Collapse

Solution	Frequency	Percentage (%)
Frequent Maintenance	8	8.8
Use of Quality Materials	18	19.8
Good Design	6	6.6
Involvement of Professionals	11	12.1
All of the above mentioned	48	52.7
Total	91	100

According to the study, there are several ways to prevent building collapse: 8 respondents (8.8%) of the total sample population believe that frequent maintenance can prevent building collapse, 18 respondents (19.8%) believe that using quality materials can prevent building collapse, 6 respondents (6.6%) believe that good design can prevent building collapse, 11 respondents (12.1%) believe that professional involvement can prevent building collapse, and 48 respondents (52.7%) believe that all of the aforementioned options can prevent building collapse. This suggests that building collapse in Nigeria, and the Badariya area in particular, can be reduced if all the solutions are implemented, as the table above illustrates.

Discussions of findings

According to the data analysis, majority of respondents (84.6%) are male, nearly all have tertiary education (75.6%), and are considered knowledgeable because of their background in various fields. The majority of respondents—79.1%—agreed that building collapses are frequent and extremely common, with 68% of them reporting that they have witnessed building collapses. This validates the findings of the research, which show that building collapses do occur frequently nationwide. 40.7% of the respondents agreed that the use of inferior materials, poor workmanship, and a faulty foundation are the main reasons why buildings collapse, with the remaining 19.8% citing other factors.

It is found out that 87.9% of residential and commercial properties are susceptible to building collapse; the majority of these properties are privately owned and have a greater tendency to collapse. Building collapse in the Badariya area of Kebbi state has resulted in numerous problems; 91.2% of respondents overall concurred that building collapse has consequences and issues. The impact on human lives is 71.5%, 69.3%

on properties, and 70.4% on the development of housing. In the meantime, both recently constructed and older properties fell apart.

Developers can reduce building collapse by following statutory building regulations, which resulted in 46.2% of cases, and by ceasing to deal with quacks, which resulted in 35.2% of cases. The use of high-quality materials is said to be the answer to the issues surrounding building collapse, accounting for 19.8% of all the solutions presented in this research study. The research findings indicate that substandard material is the primary cause of building collapse. This implies that the use of quality materials can prevent or minimize building collapse, with professional involvement following at 12.1%.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary of Findings

Following a thorough examination of the information obtained from the participants, the following is an overview of the conclusions:

1. According to the analysis, majority of respondents are male and have both witnessed and knowledge of building collapse incidents in the study area.
2. The participants concurred that the impact of a building collapsing is significant, leading to numerous issues for building occupants, developers, the government, and relevant professionals. It was also decided that the rate of building collapse in Birnin Kebbi area is typical and that professionals and Government are working to eliminate the problem(s) by educating the public and providing adequate on-site supervision.
3. The study area's personnel and professionals, who were the respondents, identified the following as the main reasons behind building collapses: the use of sub-standard materials. Faulty foundation combined with poor craftsmanship are the primary causes of building collapse in the study area. Building collapse in the study area is also attributed to poor maintenance and mistakes in design.

Conclusion

In summary, the purpose of this paper is to evaluate the factors that contribute to building collapse. This was accomplished by determining that the most common cause of building failure was the use of inferior materials, which was followed by shoddy construction and a faulty foundation. Building collapses have a significant impact on people's lives, property, and the development of housing, as this study has demonstrated. The study area is plagued by a number of issues, including personal greed on the part of some developers, corrupt government agencies operating there, and inexperienced contractors and project managers in the building industry.

Because they lack the funds to develop their properties and are desperate to own one, most property developers hire quacks; some government agencies take bribes and are unable to oversee construction projects thoroughly; contractors and project managers have neglected the use of high-quality building materials. In Badariya, these has become a tradition. Building collapse incidents require the attention of pertinent stakeholders, including state chapters of the Nigerian Institute of building (NIOB) and Council of Registered Builders of Nigeria (CORBON), FED MIN. OF WORKS AND HOUSING ETC., and the Nigerian government.

Recommendations

Following a thorough examination and interpretation of information gleaned from primary and secondary sources, the following recommendations were made:

1. Building materials should be inspected at appropriate intervals under the supervision and monitoring of an approved team to guarantee that subpar materials are not used in construction projects nationwide.
2. The government ought to implement legislation with the goal of putting an end to the use of inferior materials throughout the nation and guaranteeing that the cost of superior materials is controlled or subsidized so that people of all income levels can afford it.
3. Structural engineers should carefully design the foundation of buildings and take it into account before placing any weight on it. This will decide the building's floor plan and the type of soil to be used before construction begins.
4. Building collapse can be minimized, if not completely prevented, by using proper workmanship during construction. To achieve this, qualified professionals need to be involved in all the construction process
5. Professionals from the building industry, including builders, engineers, architects, town planners, quantity surveyors, estate surveyors, and values as project managers and estimators, must convene periodically to deliberate on issues impacting the sector and offer solutions.

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